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DEPARTMENT OF THE ARMY FIELD MANUAL

NUCLEAR PLAY CALCULATOR AGGRESSOR



HEADQUARTERS, DEPARTMENT OF THE ARMY

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FIELD MANUAL

No. 105-6-3

HEADQUARTERS
DEPARTMENT OF THE ARMY
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NUCLEAR PLAY CALCULATOR AGGRESSOR

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Purpose and Scope

a. This manual provides guidance on procedures and techniques for evaluating the nuclear play of Aggressor forces during tactical exercises.

b. This manual provides the necessary aids for the Aggressor to determine the damage to United States and Allied forces from nuclear strikes.

c. The weapon systems in this manual are based on material contained in the Handbook on Aggressor Military Forces, FM 30-102.

1-2. Definitions of Terms Used in this Manual

a. *Nuclear play calculator (NPC)*—A device for applying performance probabilities to nuclear delivery systems.

b. *Horizontal dispersion template*—An aid used to determine the actual ground zero (AGZ) of the nuclear weapon. The letters in the horizontal dispersion table correspond to those on the template and indicate the distance the weapon impacted from ground zero. A zero indicates a detonation at the desired ground zero.

c. *Damage letters*—Letters which signify different target categories normally assessed in nuclear weapons employment.

d. *Damage circle template*—An aid used in conjunction with the damage letters to evaluate the damage to personnel and equipment.

e. *Target element table*—A table which describes the target categories and the damage to be expected within each lettered damage circle.

f. *Damage circle radii*—The radii of damage for a particular type of target.

g. *Damage circle radii tables*—A series of tables showing the damage radii, in hundreds of meters, to be assessed for each target category, based on the height of burst (HOB) and the weapon yield. Data given are for commonly occurring target elements. For target elements not enumerated, damage corresponding to the most closely related item shown is assessed.

1-3. Changes to the Manual

Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded to Commandant, U.S. Army Artillery and Missile School, ATTN: AKPSIPL, Fort Sill, Okla.

1-4. References

See appendix A for list of references.

1-5. Organization

a. Chapter 1 provides an introduction to the manual and an explanation of the use of the nuclear play calculator in evaluating the strike effects in nuclear play.

b. Chapter 2 contains the tables for Aggressor strike assessments from nuclear weapons.

c. Chapter 3 contains the damage radii tables for the nuclear weapons employed by the Aggressor forces. LARGE STRATEGIC WEAPONS (20MT-100MT) were not included in this tactical manual. Source data for damage tables were extracted from FM 101-31-3.

Section II. INSTRUCTIONS FOR USE OF THE NUCLEAR PLAY CALCULATOR

1-6. Purpose and Use of the Nuclear Play Calculator

a. The nuclear play calculator is designed to provide a simple and convenient means for applying weapon performance probabilities in determining the actual ground zero and various damage radii resulting from a nuclear burst simulated during tactical exercises.

b. To obtain the maximum value from a training standpoint, elements of the target area must be portrayed in appropriate detail on a map used with the nuclear play calculator. A map scale of 1:50,000 or larger is appropriate for this purpose. If a map of the required scale is not available, a grid sheet showing the most prominent terrain features may be substituted.

c. To achieve a better evaluation when small, tactical nuclear weapons (less than 100 KT) are employed, the area occupied by the smallest tactical unit (normally a platoon) should be indicated on the map or sketch used for damage assessment. With very-small-yield weapons, target detail should include each individual crew-served weapon, tank, and squad-size unit.

1-7. Strike Assessment

a. The decision to employ an Aggressor nuclear weapon requires that the following information be furnished to the appropriate umpire/control personnel for the strike assessment.

- (1) *Army delivered weapons.*
 - (a) Delivery system (cannon, free rocket, etc.).
 - (b) Location of delivery unit (coordinates).
 - (c) Desired ground zero (coordinates).
 - (d) Desired height of burst in meters.
 - (e) Yield in kilotons.
 - (f) Time of delivery.
- (2) *Air-delivered weapons.*
 - (a) Type of delivery aircraft (fighter, bomber).
 - (b) Direction of flight over target.

- (c) Desired ground zero (coordinates).
- (d) Desired height of burst in meters.
- (e) Yield in kilotons.
- (f) Time of delivery.

b. An Aggressor strike assessment (fig. 1-1) is made by using the suitable section of chapter 2 for the delivery system indicated.

c. The following steps are required to make the strike assessment:

- (1) Determine in-flight performance.
- (2) Locate the actual ground zero of the weapon.
- (3) Find the actual height of burst.
- (4) Determine from the appropriate tables in chapter 3 the damage circle radii applicable to the strike conditions determined for the assessment.

d. Upon completion of the strike assessment, the following information is disseminated:

- (1) The coordinates of actual ground zero.
- (2) A target letter and the corresponding damage radii for each of the target elements of interest for the strike.
- (3) Time of delivery of the weapon.

e. The control organization determines whether fallout will occur in case of a surface or a low air burst. This is determined from the column in the damage circle table marked FAF (fallout adjustment factor). A zero in this column indicates no militarily significant fallout; any number other than zero indicates militarily significant fallout. The dose rate values considered proper for a surface burst must be multiplied by the fallout adjustment factor to correct for the actual burst height condition. the chemical, biological, and radiological umpire should be notified that fallout will occur and should be given the fallout adjustment factor so that he may consider this adjustment in establishing fallout patterns.

f. The information from the completed strike assessment form becomes the basic data for transmission of information to the appropriate personnel.

AGGRESSOR ASSESSMENT SHEET FOR NUCLEAR MISSIONS

1. Mission number: _____.

2. Input data.

*Army-delivered systems**Air-delivered system*

- | | |
|--|--------------------------------|
| a. Delivery system: _____ | a. Type of aircraft: _____ |
| b. Location of delivery unit: _____
(coordinates) | b. Direction of flight: _____ |
| c. DGZ: _____
(coordinates) | c. DGZ: _____
(coordinates) |
| d. Desired HOB (meters): _____ | d. Desired HOB (meters): _____ |
| Preset HOB option: _____ | e. Yield KT: _____ |
| e. Yield KT: _____ | f. Time of delivery: _____ |
| f. Time of delivery: _____ | |

3. Dud or failed-safe occurrence: Yes _____. No _____.

4. Range in meters (Army-delivered weapons only): _____.

5. Determination of actual ground zero:

Desired ground zero (from paragraph 2c above): _____.

Throw one die. Number: _____. Sector line: _____.

Throw three dice. Sum: _____. Dispersion circle (line or ellipse): _____.

Actual ground zero: _____
(coordinates)

6. Determination of actual height of burst:

Throw three dice. Sum: _____.

Desired HOB (from paragraph 2 above): _____.

Vertical error (including sign): _____.

Actual HOB (meters): _____.

7. Damage circles (from actual HOB and yield):

T _____	P _____	DP _____	B _____	TB _____	C _____
V _____	X _____	DX _____	I _____	FAF _____	

Figure 1-1. Aggressor sample assessment sheet.





CHAPTER 2

STRIKE ASSESSMENT PROCEDURES

Section I. STRIKE ASSESSMENT PROCEDURES FOR CANNONS (203-MM GUN/HOWITZER, 240-MM MORTAR, 310-MM GUN, 400-MM MORTAR)

2-1. In-Flight Performance

To determine in-flight performance, roll three dice. If the sum is 18, the round is a dud. Notify the appropriate umpires and proceed no further.

Note. If aggressor artillery units are employed, delays, aborts, or malfunctions caused by improper actions at the delivery unit should be assessed by the delivery unit umpire, and the appropriate umpires should be notified. Weapon performance probabilities included in this section assume a correct fitting of the round.

2-2. Actual Ground Zero

To determine the actual ground zero, place the horizontal dispersion template for this weapon over the desired ground zero (DGZ) with the direction of fire properly aligned. Throw three dice, and enter table 2-1 with the sum of the dice and the range to determine a letter that designates the proper dispersion line. The intersection of this dispersion line with the direction-of-fire line will be the actual ground zero.

Table 2-1. Horizontal Dispersion (Cannons)

Sum of dice	Range (in thousands of meters)					
	2 to 5	5 to 15	10 to 15	15 to 20	20 to 25	25 to 30
3	b	o	e	o	i	a
4	o	e	a	c	i	o
5	a	c	a	i	i	o
6	o	o	e	g	o	g
7	a	c	c	o	g	a
8	a	a	c	e	a	e

Table 2-1. Horizontal Dispersion (Cannons)—Continued.

Sum of dice	Range (in thousands of meters)					
	2 to 5	5 to 15	10 to 15	15 to 20	20 to 25	25 to 30
9	o	a	o	a	e	c
10	o	o	a	c	c	i
11	o	o	b	d	d	j
12	o	b	o	b	f	d
13	b	b	d	f	b	f
14	b	o	d	o	h	b
15	o	o	f	h	o	h
16	b	d	b	j	j	o
17	o	f	b	d	j	o
18	b	o	f	o	j	b

2-3. Actual Height of Burst

To determine the actual height of burst, throw three dice. Enter table 2-2 with the sum of the dice and the range, and determine the vertical error. If the sum of the dice is odd, subtract the error from the desired height of burst; if the sum is even, add the error to the desired height of burst to find the actual height of burst. A negative actual height of burst should be read as an impact round and considered a dud. If a dud occurs from this cause, notify the appropriate umpires and proceed no further.

Table 2-2. Range and Vertical Error (Cannons)

10 or 11	0	0	0	0	0	5	5	5	5	5	5	5	10	10	10
9 or 12	0	5	5	5	10	10	10	10	15	15	20	20	20	20	20
8 or 13	5	5	10	10	15	15	20	20	25	30	30	30	30	35	40
7 or 14	5	10	10	15	20	25	25	30	35	40	40	45	45	50	55
6 or 15	10	15	15	20	25	30	35	40	45	50	55	55	60	65	70
5 or 16	10	15	20	25	35	40	45	50	55	60	65	70	75	80	90
4 or 17	15	20	25	35	40	50	55	60	65	75	80	90	95	100	110
3 or 18	20	25	30	40	50	60	65	70	80	95	100	105	115	125	130
Sum of dice	Vertical error (in meters) for ranges 2-16 kilometers														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Range (in kilometers)														
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
	Vertical error (in meters) for ranges 17-30 kilometers														
10 or 11	10	10	10	10	10	10	10	10	15	15	15	15	15	15	
9 or 12	25	25	25	30	30	30	30	35	35	35	40	40	40	40	
8 or 13	40	45	45	50	50	50	55	60	60	60	65	70	70	70	
7 or 14	60	60	65	70	70	75	75	80	85	90	90	95	100	100	
6 or 15	75	80	85	90	90	95	100	105	110	115	120	120	130	130	
5 or 16	95	100	100	110	115	120	125	130	135	140	150	155	160	165	
4 or 17	115	120	125	135	145	145	150	160	170	175	180	190	195	200	
3 or 18	140	150	155	165	170	175	185	200	210	215	225	230	240	250	

2-4. Damage Circle

To determine the damage circle, enter the damage circle radii tables in chapter 3 with the yield of the

weapon and the actual height of burst (par. 2-3) to determine the damage circle numbers for the target elements of interest in this strike.





Section II. STRIKE ASSESSMENT PROCEDURES FOR FREE ROCKETS (NERONO, KOLOSSO)

2-5. In-Flight Performance

To determine in-flight performance, roll three dice. If the sum is 3 or 18, the round is a dud. Notify the appropriate umpires and proceed no further.

Note. If Aggressor artillery units are employed, delays, aborts, or malfunctions caused by improper actions at the delivery unit should be assessed by the delivery unit umpire, and the appropriate umpires should be notified. Weapon performance probabilities included in this section assume a correct firing of the rocket.

2-6. Actual Ground Zero

To determine the actual ground zero—

a. Place the horizontal dispersion template for this weapon over the desired ground zero with the direction of fire properly aligned.

b. Throw one die. The number on the die designates a radial line in table 2-3. This line is the proper radial direction line on the horizontal dispersion template for this weapon.

c. Throw three dice, and enter table 2-4 with the sum of the dice and the range to determine a letter that designates the proper dispersion ellipse. The intersection of this dispersion ellipse with the radial line determined in *b* above will be the actual ground zero.

2-7. Actual Height of Burst

To determine the actual height of burst, throw three dice. Enter table 2-5 with the sum of the dice and the range, and determine the vertical error. If the sum of the dice is odd, subtract the error from the desired height of burst to find the actual height of burst. If the sum is even, add the error to the desired height of burst to find the actual height of burst. A negative actual height of burst should be considered an impact or surface burst.

2-8. Damage Circle

To determine the damage circle, enter the damage circle radii tables in chapter 3 with the yield of the weapon and the actual height of burst (par. 2-7) to determine the damage circle numbers for the target elements of interest in this strike.

Table 2-3. Direction (Free Rockets)

Number	Direction
1	I
2	II
3	III
4	IV
5	V
6	VI

Table 2-4. Horizontal Dispersion (Free Rockets)

Sum of dice	Range (in thousands of meters)									
	8 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 58
3	a	b	a	c	d	e	e	c	f	d
4	a	a	o	a	b	o	o	o	b	o
5	a	a	b	c	d	c	e	d	f	e
6	b	b	c	d	e	f	f	g	g	g
7	a	a	o	b	b	b	a	a	e	e
8	b	b	b	b	c	e	c	d	e	e
9	b	a	b	b	b	c	e	e	f	d
10	o	o	a	a	a	a	b	b	b	c
11	o	a	a	a	a	b	b	c	c	b
12	a	a	b	c	c	d	d	f	f	e
13	a	a	a	a	b	b	c	b	d	d
14	a	b	b	c	b	d	d	e	d	f
15	o	a	a	o	b	b	a	c	a	a
16	a	o	a	a	o	a	a	a	a	d
17	b	c	c	e	d	e	e	f	g	f
18	a	b	a	c	d	e	e	c	f	d

Table 2-5. Range and Vertical Error (Free Rockets)

10 or 11	10	15	15	20	20	25	25	30	30	35	35	40	40
9 or 12	30	40	45	50	60	65	75	80	90	95	100	110	115
8 or 13	55	65	80	90	100	115	125	140	150	160	175	185	195
7 or 14	75	95	110	130	145	160	180	195	210	230	250	265	280
6 or 15	100	120	140	165	190	210	230	250	275	300	320	340	365
5 or 16	125	150	180	205	230	260	290	315	345	370	400	425	455
4 or 17	150	185	220	260	290	310	360	390	425	460	495	525	560
3 or 18	185	230	270	310	350	390	440	480	520	560	605	645	685
Sum of dice	Vertical error (in meters) for ranges 8-34 kilometers												
	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34
	Range (in kilometers)												
	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50	50-52	52-54	54-56	56-58	
	Vertical error (in meters) for ranges 34-58 kilometers												
10 or 11	45	45	50	50	55	55	60	60	65	65	70	75	
9 or 12	120	130	135	145	150	155	170	170	180	185	190	205	
8 or 13	210	220	235	245	260	270	280	290	305	320	330	350	
7 or 14	300	315	330	350	370	380	400	410	435	450	470	495	
6 or 15	385	410	430	450	480	495	520	530	560	585	605	640	
5 or 16	480	510	535	565	600	620	650	660	700	730	760	800	
4 or 17	595	630	665	700	740	765	800	820	870	900	940	990	
3 or 18	730	770	810	855	905	940	980	1000	1060	1105	1150	1215	





Section III. STRIKE ASSESSMENT PROCEDURES FOR GUIDED MISSILES (TONDRO, FULMO, SUPRO, SAGO, AGLO)

2-9. In-Flight Performance

To determine in-flight performance, roll three dice. If the sum is 8 or 13, the round is a dud or failed-safe. Notify the appropriate umpires and proceed no further.

Note. If Aggressor artillery units are employed, delays, aborts, or malfunctions due to improper actions at the delivery unit should be assessed by the delivery unit umpire, and the appropriate umpires should be notified. Weapon performance probabilities included in this section assume a correct firing of the missile.

Note. TERURO a strategic weapon is not included.

2-10. Actual Ground Zero

To determine the actual ground zero—

a. Place the horizontal dispersion template for this weapon over the desired ground zero with the direction of fire properly aligned.

b. Throw one die. The number on the die designates a radial line in table 2-6. This line is the proper radial direction line on the horizontal dispersion template of this weapon.

c. Throw three dice, and enter table 2-7 with the sum of the dice and the proper missile system to determine a letter that designates the proper dispersion circle. The intersection of this dispersion circle with the radial line determined in *b* above will be the actual ground zero.

2-11. Actual Height of Burst

To determine the actual height of burst, throw three dice. Enter table 2-8 with the sum of the dice and the correct missile system and determine the vertical error. If the sum of the dice is odd, subtract the error from the desired height of burst; if the sum is even add the error to find the actual height of burst. A negative height of burst should be considered as an impact or surface burst.

Table 2-6. Direction (Guided Missiles)

Number	Direction
1	I
2	II
3	III
4	IV
5	V
6	VI

Table 2-7. Horizontal Dispersion (Guided Missiles)

Sum of dice	Guided missiles				
	Tondro	Fulmo	Supro	Sago	Aglo
3	f	g	m	a	c
4	b	a	b	a	a
5	g	i	m	a	c
6	j	j	n	b	d
7	c	c	g	a	b
8	f	i	j	a	b
9	g	g	l	a	b
10	e	e	i	o	a
11	f	f	i	a	a
12	h	h	l	a	c
13	d	d	f	o	a
14	h	j	k	a	c
15	b	b	i	a	o
16	a	f	d	a	a
17	i	k	n	b	d
18	f	g	m	a	c

Table 2-8. Vertical Error (Guided Missiles)

Sum of dice	Error (in meters)			
	Tondro	Fulmo	Supro	Sago and Aglo
10 or 11	10	15	20	25
9 or 12	20	35	55	70
8 or 13	35	60	95	120
7 or 14	50	85	135	170
6 or 15	65	110	175	220
5 or 16	80	135	220	275

Table 2-8. Vertical Area (Guided Missiles)—Continued

Sum of dice	Error (in meters)			
	Tondro	Fulmo	Supro	Sago and Aglo
4 or 17	100	170	270	340
3 or 18	125	210	330	415

2-12. Damage Circle

To determine the damage circle, enter the damage circle radii tables in chapter 3 with the yield of the weapon and the actual height of burst (par. 2-11) to determine the damage circle numbers for the target elements of interest in this strike.



Section IV. STRIKE ASSESSMENT PROCEDURES FOR AIR-DELIVERED WEAPONS (Pafago, Detruizo, Forviso)

2-13. DUD Occurrence

To determine dud occurrence, roll three dice. If the sum is 3 or 18, the round is a dud. Notify the appropriate umpires and proceed no further.

Note. If Aggressor aircraft are employed, delays or malfunctions due to improper actions at the departure airfield should be assessed by an Air Force umpire, and the appropriate umpires should be notified. In-flight performance to include damage to or destruction of the aircraft, gross delivery errors, improper delivery means, etc., must be assessed by an Air Force controller in accordance with specific exercise conditions of personnel, materiel, weather, air defense capabilities, etc. The only weapon performance probabilities included in this section assume that the bomb has been correctly released by the aircraft in the target area. This dud occurrence is only a minor factor relative to general in-flight performance.

2-14. Actual Ground Zero

To determine the actual ground zero—

a. Place the horizontal dispersion template for air-delivered weapons over the desired ground zero with the direction of flight properly aligned.

b. Throw one die. The number on the die designates a radial line in table 2-9. This line is the proper radial direction line on the horizontal dispersion template of this weapon.

Table 2-9. *Direction (Air-Delivered Weapons)*

Number	Direction
1	I
2	II
3	III
4	IV
5	V
6	VI

c. Throw three dice, and enter table 2-10 with the sum of the dice and the type of aircraft used to determine a letter that designates the proper dispersion circle. The intersection of this dispersion circle with the radial line determined in b above will be the actual ground zero.

2-15. Actual Height of Burst

To determine the actual height of burst, throw three dice. Enter table 2-11 with the sum of the dice and the type of aircraft, and determine the vertical error. If the sum of the dice is odd, subtract

the error from the desired height of burst; if the sum is even, add the error to the desired height of burst to find the actual height of burst. A negative actual height of burst should be considered as an impact or surface burst.

2-16. Damage Circle

To determine the damage circle, enter the damage circle radii tables in chapter 3 with the yield of the weapon and the actual height of burst (par. 2-15) to determine the damage circle numbers for the target elements of interest in this strike.

Table 2-10. *Horizontal Dispersion (Air-Delivered Weapons)*

Sum of dice	Aircraft		
	Pafago	Detruizo	Forviso
3	e	f	h
4	o	b	b
5	c	g	h
6	f	j	i
7	a	c	g
8	e	f	j
9	d	g	i
10	b	e	g
11	b	f	h
12	c	h	j
13	a	d	f
14	d	b	i
15	b	b	d
16	b	a	c
17	f	i	k
18	e	f	h

Table 2-11. Vertical Error (Air-Delivered Weapons)

Sum of dice	Error (in meters)		
	Pafago	Detruizo	Forviso
10 or 11	15	25	50
9 or 12	35	70	140
8 or 13	60	120	240
7 or 14	85	170	340
6 or 15	110	220	440

Table 2-11. Vertical Error (Air-Delivered Weapons)
—Continued

Sum of dice	Error (in meters)		
	Pafago	Detruizo	Forviso
5 or 16	135	275	550
4 or 17	170	340	680
3 or 18	210	415	830

Section V. STRIKE ASSESSMENT PROCEDURES FOR ATOMIC DEMOLITION MUNITIONS AND PARTISAN ATOMIC DEMOLITION MUNITIONS

2-17. Atomic Demolition Munitions

Atomic demolition munitions (ADM) may be played by assuming a surface burst and a zero horizontal error. Dud occurrence may be determined by rolling three dice. If the sum is 3 or 18, the round is

a dud. Delays, aborts, or malfunctions caused by improper actions by the emplacing unit should be assessed by the unit umpire, and the appropriate umpires should be notified.

Note. The dud probabilities included here assume that the weapon has been correctly emplaced and fired.



Section VI. STRIKE ASSESSMENT PROCEDURES FOR NEW AGGRESSOR WEAPONS

2-18. This section is reserved for new weapons.



CHAPTER 3

DAMAGE DETERMINATION

3-1. Target Element Table

Table 3-1 lists the types of targets and the target letters associated with these targets. The meaning

of the numbers in the damage circle radii tables is also shown.

Table 3-1. Target Element Table.

Target letter	Type of target	Meaning of number transmitted
T	Tanks, artillery, mortars, small arms, machineguns, masonry or concrete bridges, and recoilless rifles.	Template radius within which 85% are moderately damaged. Within 0.8 of this radius, the equipment will be severely damaged.
	Supply dumps, barbed wire, highway, railroad, and float bridges.	Template radius within which 85% of the supplies are severely damaged.
V	Vehicles, missiles, vehicular-mounted rocket launchers.	Template radius within which 85% are moderately damaged. Within 0.8 of this radius, the equipment will be severely damaged.
	Signal and electronic fire control equipment, radar antenna, and guidance and tracking radar.	Template radius within which 85% are severely damaged.
P	Personnel in tanks or foxholes.	Template radius within which 85% are immediate casualties. Remaining 15% will be casualties within 1 hour.
X	Personnel in the open.*	Template radius within which 85% are immediate casualties. Remaining 15% will be casualties within 1 hour.
DP	Delayed casualties to personnel in tanks or foxholes.	85% of the personnel in the zone between ring P and ring DP will be casualties within 1 hour. Remaining 15% will be casualties within 4 hours.
DX	Delayed casualties to personnel in the open.	85 percent of the personnel in the zone between ring X and ring DX, will be casualties within 1 hour. Remaining 15 per cent will be casualties within 4 hours.
B	Personnel in multistory apartment buildings.	Template radius within which 25% are killed, 20 per cent are seriously wounded, and 30 per cent are trapped in the debris; obstacles to movement are formed by severe damage to buildings.
TB	Tree blowdown, type II forests.*	Template radius within which 60 per cent of the trees will be blown down.
I	Induced contamination.	Template radius of the 2 rad/hr circle referenced to H+1 hour for type II soil.
C	Crater.	Radius of the crater in dry soil given in meters.

*Tree blowdown in type II forest for obstacles and casualties is found below each Damage circle radii table.
For further evaluation of forests refer to FM 101-31-3.

Table 3-1. Target Element Table—Continued.

Target letter	Type of target	Meaning of number transmitted
FAF	Fallout adjustment factor.	For low airbursts, the dose rate for a surface burst must be multiplied by this factor in order to obtain a rough approximation of the dose rates in the fallout pattern. Zero reading indicates no fallout.

For further evaluation of forests refer to FM 101-31-3.

3-2. Damage Circle Radii

Tables 3-2 through 3-15 list the damage circle

radii, in hundreds of meters, for various yields at the heights of burst indicated.

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Table 3-2. Damage Circle Radii for 0.1 KT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
250	0	0	0	0	1	2	0	0	0	0
200	0	0	0	0	2	3	0	0	0	0
150	0	0	0	1	2	3	0	0	0	0
100	0	0	1	2	3	4	0	1	0	0
80	0	0	1	2	3	4	0	1	0	0
60	0	1	2	2	3	4	1	2	0	0
40	0	1	2	2	3	4	1	2	0	0
20	1	1	2	3	4	4	1	2	0	0
0	1	1	2	3	4	5	2	*	8	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 100 meters.

Personnel 100 meters.



0.5 KT

Table 3-3. Damage Circle Radii for 0.5 KT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
550	0	0	0	0	0	3	0	0	0	0
500	0	0	0	0	0	4	0	0	0	0
450	0	0	0	0	2	4	0	1	0	0
400	0	0	0	1	3	5	1	2	0	0
350	0	0	0	2	3	5	2	2	0	0
300	0	0	0	3	4	6	3	3	0	0
250	0	0	1	3	4	6	3	3	0	0
200	0	0	2	3	4	6	4	4	0	0
150	0	0	2	4	4	6	4	4	0	0
100	0	1	2	4	5	6	4	4	0	0
50	1	2	3	4	5	6	4	4	0	0
S	1	1	3	4	5	6	4	*	16	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 300 meters.

Personnel 200 meters.





Table 3-4. Damage Circle Radii for 1 KT.

Actual HOB (meters)	T	V	P	N	DP	DN	B	I	C	FAF
600	0	0	0	0	0	4	0	0	0	0
550	0	0	0	1	2	5	0	1	0	0
500	0	0	0	2	3	6	0	1	0	0
450	0	0	0	3	3	6	1	2	0	0
400	0	0	1	4	4	6	2	2	0	0
350	0	0	2	4	4	7	3	2	0	0
300	0	0	2	4	5	7	5	3	0	0
250	0	0	3	5	5	7	5	3	0	0
200	0	0	3	5	5	7	5	4	0	0
150	0	2	3	5	5	7	5	4	0	0
100	1	2	4	5	5	7	5	4	0	0
50	1	2	4	5	6	7	5	4	0	0
S	1	1	4	5	6	7	5	*	20	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 400 meters.

Personnel 300 meters.



Table 3-5. Damage Circle Radii for 2 KT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
750	0	0	0	0	0	4	0	0	0	0
700	0	0	0	0	1	5	0	0	0	0
650	0	0	0	0	2	6	0	1	1	1
600	0	0	0	1	3	6	0	2	0	0
550	0	0	0	3	4	7	2	2	0	0
500	0	0	0	3	4	7	3	2	0	0
450	0	0	1	4	5	7	4	2	0	0
400	0	0	2	4	5	7	4	3	0	0
350	0	0	3	5	6	8	6	3	0	0
300	0	0	3	5	6	8	6	4	0	0
250	0	1	4	5	6	8	6	4	0	0
200	0	2	4	5	6	8	6	5	0	0
150	1	3	4	6	6	8	5	5	0	0
100	1	3	4	6	6	8	5	5	0	0
50	2	3	4	6	6	9	6	5	0	0
S	1	2	4	6	6	9	6	*	25	1

*Fallout governs.

Tree blowdown type II forest.

Obstacles 500 meters.

Personnel 300 meters.





Table 3-6. Damage Circle Radii for 5 KT.

Actual HOB (meters)	T	V	P	N	DP	DX	B	I	C	FAF
800	0	0	0	0	2	6	0	0	0	0
750	0	0	0	2	3	7	0	1	0	0
700	0	0	0	3	4	7	1	2	0	0
650	0	0	0	4	5	8	3	2	0	0
600	0	0	1	5	5	8	3	2	0	0
550	0	0	3	5	6	9	4	3	0	0
500	0	0	3	6	6	9	8	3	0	0
450	0	0	4	6	7	9	9	3	0	0
400	0	0	4	7	7	9	9	4	0	0
350	0	1	5	7	7	9	9	5	0	0
300	0	2	5	7	7	10	8	5	0	0
250	0	4	5	7	7	10	8	6	0	0
200	1	4	6	7	8	10	8	6	0	0
150	2	4	6	7	8	10	7	6	0	0
100	3	5	6	8	8	10	7	6	0	0
50	3	4	6	8	8	10	7	*	0	.1
S	2	3	6	8	8	10	7	*	35	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 800 meters.

Personnel 600 meters.





10-KT

Table 3-7. Damage Circle Radii for 10 KT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
950	0	0	0	0	0	7	0	0	0	0
900	0	0	0	0	2	7	0	0	0	0
850	0	0	0	2	3	8	0	1	0	0
800	0	0	0	4	4	8	1	2	0	0
750	0	0	0	5	5	9	5	2	0	0
700	0	0	1	5	6	9	6	3	0	0
650	0	0	2	6	6	9	12	3	0	0
600	0	0	3	6	7	10	12	3	0	0
550	0	0	4	7	7	10	12	3	0	0
500	0	0	5	8	7	10	12	4	0	0
450	0	1	5	8	8	10	12	5	0	0
400	0	2	5	8	8	11	11	6	0	0
350	0	4	6	8	8	11	11	6	0	0
300	1	5	6	8	8	11	10	6	0	0
250	1	6	6	8	9	11	10	6	0	0
200	2	6	6	8	9	11	10	7	0	0
150	3	6	7	8	9	11	9	7	0	0
100	3	6	7	9	9	11	9	7	0	0
50	3	6	7	9	9	11	9	*	0	.1
S	3	4	7	9	9	11	8	*	40	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 1,000 meters.

Personnel 800 meters.



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Table 3-8. Damage Circle Radii for 20 KT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
1,050	0	0	0	0	0	7	0	0	0	0
1,000	0	0	0	0	2	7	0	0	0	0
950	0	0	0	3	4	8	4	1	0	0
900	0	0	0	4	5	8	6	2	0	0
850	0	0	0	5	5	9	8	2	0	0
800	0	0	0	6	6	9	11	2	0	0
750	0	0	2	6	7	10	15	3	0	0
700	0	0	4	7	7	10	15	3	0	0
650	0	0	4	10	8	10	15	4	0	0
600	0	0	5	11	8	11	15	4	0	0
550	0	2	5	11	8	11	14	5	0	0
500	0	3	6	11	9	11	14	6	0	0
450	0	6	6	11	9	11	13	6	0	0
400	1	7	7	11	9	12	13	6	0	0
350	2	7	7	11	9	12	12	7	0	0
300	2	8	7	11	9	12	12	7	0	0
250	3	8	7	11	10	12	12	7	0	0
200	4	8	7	11	10	12	12	8	0	0
150	5	8	8	11	10	12	11	8	0	0
100	5	8	8	10	10	12	11	8	0	0
50	5	7	8	10	10	12	11	*	40	2
S	4	6	8	10	10	12	11	*	50	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 1,300 meters.

Personnel 1,000 meters.



50 KT



Table 3-9. Damage Circle Radii for 50 KT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
1,300	0	0	0	0	0	7	9	0	0	0
1,250	0	0	0	0	0	8	11	0	0	0
1,200	0	0	0	0	0	8	13	0	0	0
1,150	0	0	0	2	2	9	14	0	0	0
1,100	0	0	0	4	4	9	21	1	0	0
1,050	0	0	1	5	5	10	21	2	0	0
1,000	0	0	3	6	6	10	21	3	0	0
950	0	0	4	7	7	11	21	3	0	0
900	0	0	5	13	7	13	21	3	0	0
850	0	0	6	15	8	15	21	4	0	0
800	0	1	7	16	8	16	21	4	0	0
750	0	2	7	16	9	16	20	4	0	0
700	0	4	8	16	9	16	20	5	0	0
650	0	6	8	16	10	16	20	6	0	0
600	0	9	8	16	10	16	19	7	0	0
550	1	9	9	16	10	16	19	7	0	0
500	2	10	9	16	10	16	18	7	0	0
450	3	11	9	10	11	16	18	7	0	0
400	4	11	9	16	11	16	17	8	0	0
350	5	11	10	16	11	16	17	8	0	0
300	6	12	10	16	11	16	16	8	0	0
250	7	12	10	16	11	16	16	9	0	0
200	7	12	10	16	11	16	16	9	0	0
150	7	12	10	15	11	15	15	9	0	0
100	7	12	10	15	11	15	15	*	0	.1
50	6	10	10	14	11	14	15	*	50	.4
S	5	8	10	13	11	13	15	*	70	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 2,100 meters.

Personnel 1,500 meters.



Table 3-11. Damage Circle Radii for 200 KT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
1,700	0	0	0	0	0	0	33	0	0	0
1,600	0	0	2	0	2	9	33	0	0	0
1,400	0	0	6	24	6	24	33	0	0	0
1,300	0	1	8	28	8	28	33	2	0	0
1,200	0	4	9	28	9	28	32	3	0	0
1,100	0	7	9	28	9	28	31	4	0	0
1,000	1	13	10	28	10	28	31	5	0	0
900	2	16	10	28	11	28	30	5	0	0
850	3	17	10	28	11	28	29	6	0	0
800	4	18	10	28	12	28	29	7	0	0
750	4	18	10	28	12	28	29	7	0	0
700	5	19	10	28	12	28	28	8	0	0
650	6	19	10	28	13	28	27	8	0	0
600	7	20	10	28	13	28	27	9	0	0
550	9	20	10	28	13	28	27	9	0	0
500	10	21	10	28	13	28	26	10	0	0
450	11	21	10	28	13	28	26	10	0	0
400	12	21	10	28	13	28	26	10	0	0
300	12	21	11	28	14	28	25	*	0	.1
200	13	21	11	27	14	27	24	*	95	.4
100	12	19	11	25	14	25	24	*	85	.7
S	9	14	12	22	14	22	23	*	115	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 3,200 meters.

Personnel 2,400 meters.



100 KT

Table 3-10. Damage Circle Radii for 100 KT.

Actual HOB (meters)	T	V	P	X	DP	DN	B	I	C	FAF
1,350	0	0	0	0	0	9	26	0	0	0
1,300	0	0	1	0	1	10	27	0	0	0
1,250	0	0	2	0	3	11	27	2	0	0
1,200	0	0	3	0	5	11	27	2	0	0
1,100	0	0	5	19	7	19	26	3	0	0
1,000	0	2	6	21	8	21	26	4	0	0
900	0	4	7	21	9	21	25	4	0	0
850	0	6	8	21	10	21	24	4	0	0
800	0	9	8	21	10	21	24	5	0	0
750	0	12	8	21	10	21	24	6	0	0
700	1	13	8	21	11	21	23	7	0	0
650	2	13	8	21	11	21	23	8	0	0
600	3	14	8	21	11	21	22	8	0	0
550	4	14	9	21	11	21	23	8	0	0
500	5	15	9	21	12	21	21	8	0	0
450	6	15	9	21	12	21	21	9	0	0
400	7	16	9	21	12	21	21	9	0	0
350	9	16	9	21	12	21	20	10	0	0
300	9	16	10	21	12	21	20	10	0	0
250	9	16	10	21	12	21	20	10	0	0
200	9	16	10	21	12	21	20	10	0	0
150	9	16	10	20	13	20	19	10	0	0
100	9	15	10	19	13	19	19	*	0	.2
50	8	13	10	18	13	18	19	*	60	.5
S	7	11	10	17	13	17	18	*	90	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 2,600 meters.

Personnel 2,000 meters.



500 KT



Table 3-12. Damage Circle Radii for 500 KT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
3,200	0	0	2	0	2	0	46	0	0	0
2,100	0	0	5	0	5	4	46	0	0	0
2,000	0	0	7	0	7	7	46	0	0	0
1,900	0	0	9	35	9	35	46	0	0	0
1,800	0	0	10	40	10	40	45	0	0	0
1,700	0	4	11	41	11	41	44	0	0	0
1,600	0	7	12	41	12	41	43	0	0	0
1,500	0	10	13	41	13	41	42	0	0	0
1,400	0	15	14	41	14	41	41	2	0	0
1,300	1	22	14	41	14	41	41	3	0	0
1,200	3	24	14	41	14	41	40	4	0	0
1,100	5	26	14	41	14	41	39	6	0	0
1,000	7	27	14	41	14	41	38	7	0	0
900	9	28	14	41	14	41	37	8	0	0
800	11	29	13	41	13	41	37	9	0	0
750	12	29	13	41	13	41	36	10	0	0
700	14	30	13	41	13	41	36	10	0	0
650	16	30	13	41	15	41	35	10	0	0
600	17	31	13	41	15	41	35	11	0	0
550	17	31	13	41	15	41	35	11	0	0
500	18	31	13	41	15	41	34	11	0	0
400	18	31	14	40	16	40	34	*	0	.1
300	18	30	14	39	16	39	33	*	0	.3
200	18	29	15	37	16	37	33	*	115	.6
100	17	26	15	35	16	35	32	*	90	.7
S	14	21	16	32	16	32	32	*	155	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 4,800 meters.

Personnel 3,600 meters.





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Table 3-13. Damage Circle Radii for 1 MT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
2,200	0	3	14	53	14	53	57	0	0	0
2,100	0	7	15	54	15	54	56	0	0	0
2,000	0	10	16	54	16	54	56	0	0	0
1,900	0	13	16	54	16	54	55	0	0	0
1,800	0	17	17	54	17	54	54	0	0	0
1,700	0	26	17	54	17	54	53	0	0	0
1,600	2	30	18	54	18	54	52	2	0	0
1,500	4	32	18	54	18	54	51	3	0	0
1,400	6	34	18	54	18	54	50	4	0	0
1,300	8	35	18	54	18	54	49	5	0	0
1,200	11	36	17	54	17	54	49	5	0	0
1,100	13	37	17	54	17	54	48	6	0	0
1,000	15	38	17	54	17	54	47	9	0	0
900	18	39	17	54	17	54	46	10	0	0
800	21	40	17	54	17	54	45	11	0	0
700	23	41	17	54	17	54	44	12	0	0
600	23	41	17	54	17	54	44	12	0	.1
500	24	41	17	53	17	53	43	*	0	.2
400	24	40	18	52	18	52	43	*	0	.3
300	24	40	18	50	18	50	42	*	0	.4
200	23	38	19	48	19	48	42	*	0	.6
100	22	33	20	46	20	46	41	*	130	.9
S	18	27	21	42	21	42	41	*	195	1

*Fallout governs.
 Tree blowdown type II forests.
 Obstacles 6,200 meters.
 Personnel 4,600 meters.





Table 3-14. Damage Circle Radii for 2 MT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
2,200	0	28	22	72	22	72	67	0	0	0
2,100	1	38	22	72	22	72	66	0	0	0
2,000	3	40	22	72	22	72	65	0	0	0
1,900	5	43	23	72	23	72	64	0	0	0
1,800	8	44	23	72	23	72	64	0	0	0
1,700	10	45	22	72	22	72	63	2	0	0
1,600	12	47	22	72	22	72	62	3	0	0
1,500	14	48	22	72	22	72	61	4	0	0
1,400	17	49	22	72	22	72	60	5	0	0
1,300	19	50	22	72	22	72	59	6	0	0
1,200	22	51	21	72	21	72	59	9	0	0
1,100	25	52	21	72	21	72	58	9	0	0
1,000	28	53	21	72	21	72	57	10	0	0
900	30	54	21	71	21	71	56	11	0	0
800	31	54	21	71	21	71	56	12	0	0
700	31	54	21	70	21	70	55	*	0	.1
600	32	54	22	69	22	69	54	*	0	.2
500	32	53	22	68	22	68	53	*	0	.3
400	32	53	23	67	23	67	53	*	0	.4
300	31	51	24	65	24	65	52	*	0	.6
200	30	48	24	62	24	62	51	*	190	.7
100	28	42	25	59	25	59	51	*	140	.9
S	24	36	26	56	26	56	50	*	240	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 7,400 meters.

Personnel 5,200 meters.





Table 3-15. Damage Circle Radii for 5 MT.

Actual HOB (meters)	T	V	P	X	DP	DX	B	I	C	FAF
2,500	10	63	31	104	31	104	87	0	0	0
2,400	12	64	31	104	31	104	86	0	0	0
2,300	15	66	30	104	30	104	85	0	0	0
2,200	17	67	30	104	30	104	84	0	0	0
2,100	19	68	30	104	30	104	83	0	0	0
2,000	22	70	30	104	30	104	82	0	0	0
1,900	24	71	30	104	30	104	82	0	0	0
1,800	27	72	29	104	29	104	81	3	0	0
1,700	29	73	29	104	29	104	80	4	0	0
1,600	32	74	29	104	29	104	80	5	0	0
1,500	36	75	29	104	29	104	79	6	0	0
1,400	40	76	28	104	28	104	78	6	0	0
1,300	42	77	29	104	29	104	78	9	0	0
1,200	44	78	29	103	29	103	77	11	0	0
1,100	45	78	29	102	29	103	77	12	0	0
1,000	45	79	29	103	29	102	76	13	0	0
900	46	78	29	101	29	101	75	*	0	.2
800	46	78	30	100	30	100	75	*	0	.3
700	46	77	30	99	30	99	74	*	0	.4
600	46	77	31	98	31	98	73	*	0	.4
500	46	76	32	96	32	96	73	*	0	.5
400	45	74	32	94	32	94	72	*	0	.6
300	44	71	33	91	33	91	72	*	0	.7
200	42	65	34	88	34	88	71	*	235	.8
100	39	59	35	85	35	85	71	*	100	.9
S	35	53	36	81	36	81	70	*	330	1

*Fallout governs.

Tree blowdown type II forests.

Obstacles 12,000 meters.

Personnel 8,000 meters.

APPENDIX A

REFERENCES

FM 6-40	Field Artillery Cannon Gunnery.
FM 30-102	Handbook on Aggressor Military Forces.
FM 101-31-1	Staff Officers Field Manual, Nuclear Weapons Employment.
FM 101-31-3	Staff Officers Field Manual, Nuclear Weapons Employment.
FM 105-5	Maneuver Control.

FM 105-6-3

App. A-2

TAGO 10268-A

By Order of the Secretary of the Army:

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

EARLE G. WHEELER,
General, United States Army,
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NG: State AG (3).

USAR: Units—same as active Army.

For explanation of abbreviations used, see AR 320-50.

☆ U.S. Government Printing Office: 1964—725709

APPENDIX B

NUCLEAR PLAY CALCULATOR AIDS

1. Horizontal dispersion templates (scales 1:50,000 and 1:25,000) for--
 - a. Cannons.
 - b. Free rockets.
 - c. Guided missiles and air delivered weapons.
2. Damage circle template (scale 1:50,000).
3. Damage circle template (scale 1:25,000).

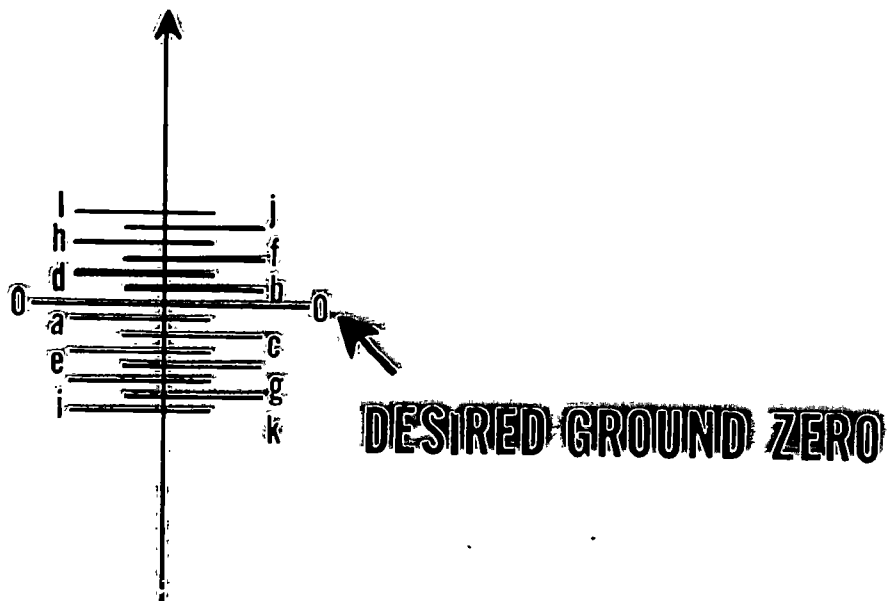
0

0

3000031554

HORIZONTAL DISPERSION TEMPLATE CANNON

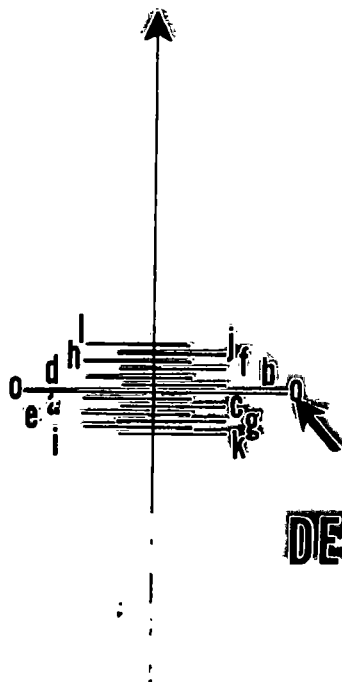
DIRECTION OF FLIGHT



SCALE 1: 25,000

HORIZONTAL DISPERSION TEMPLATE CANNON

DIRECTION OF FLIGHT

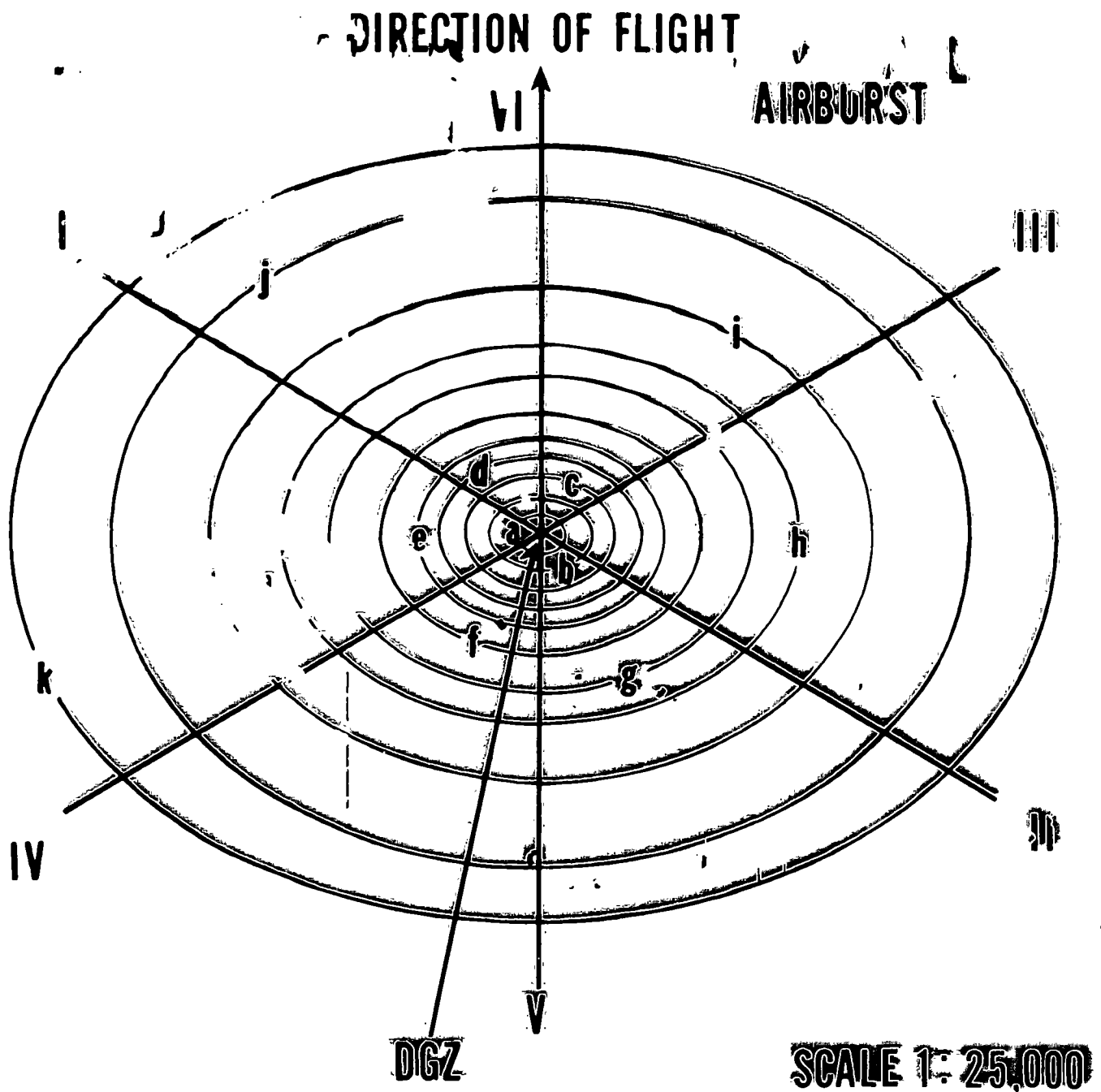


DESIRED GROUND ZERO

SCALE 1:50,000

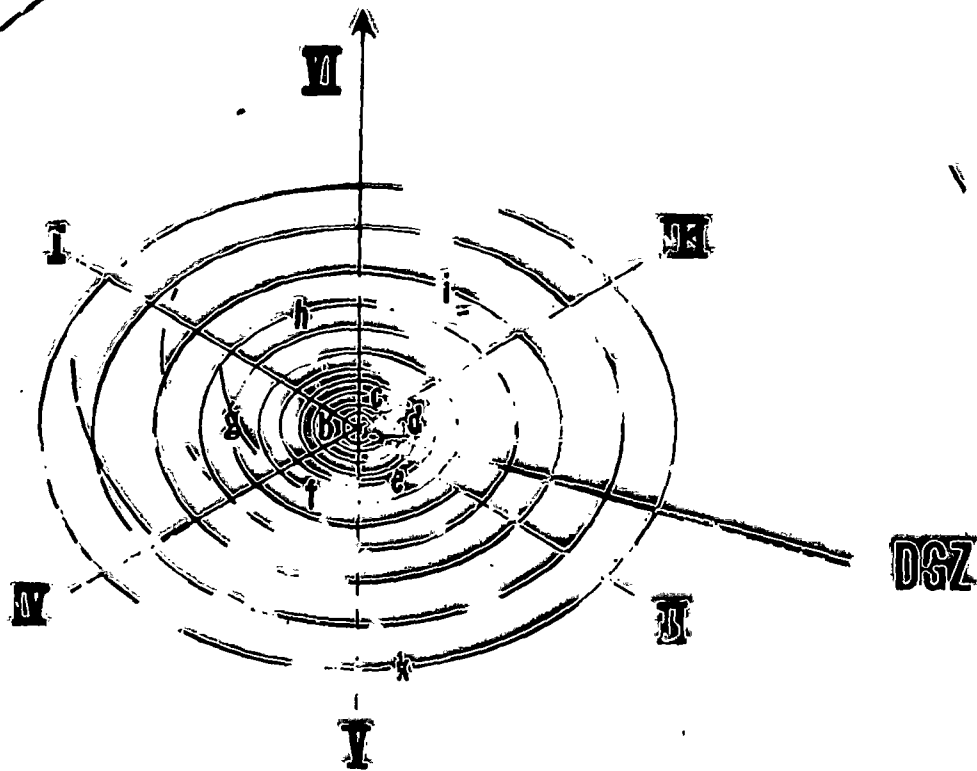
HORIZONTAL DISPERSION TEMPLATE

FREE ROCKETS



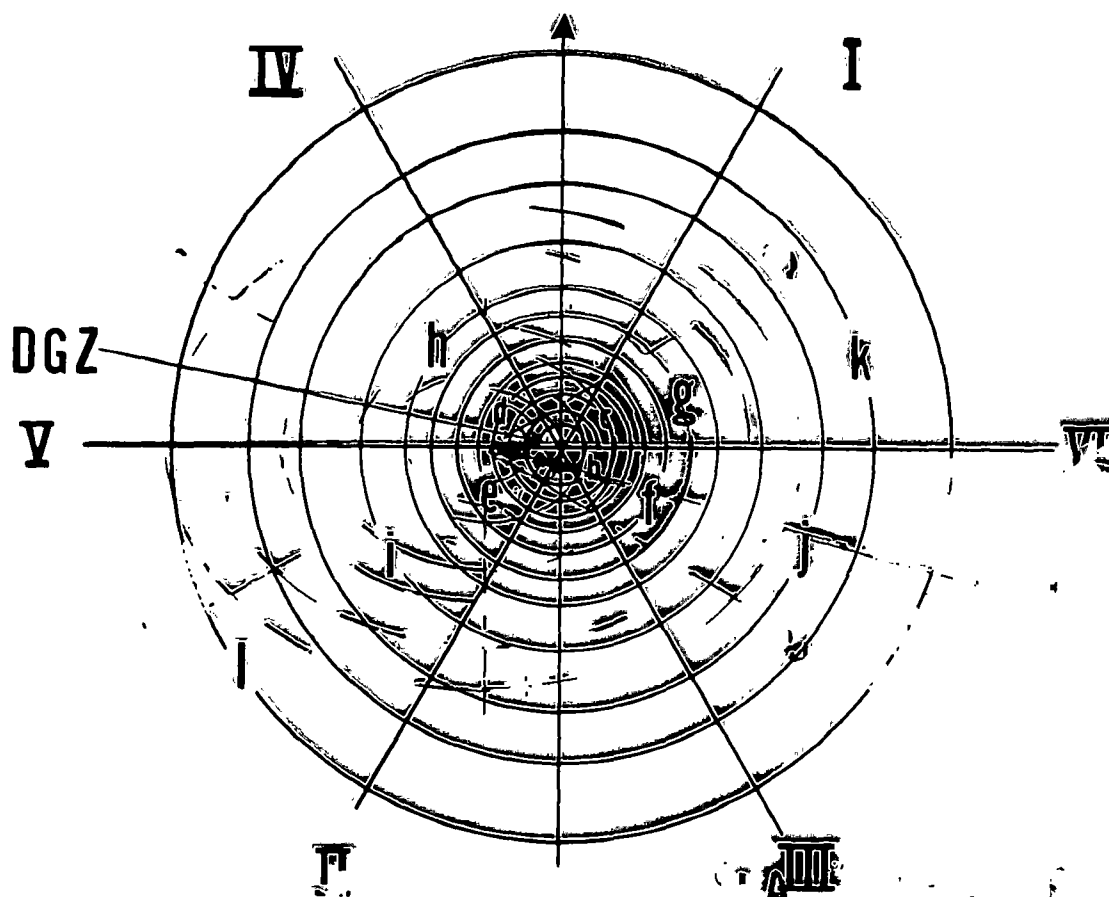
HORIZONTAL DISPERSION TEMPLATE FREE ROCKETS

~~DIRECTION OF FLIGHT~~



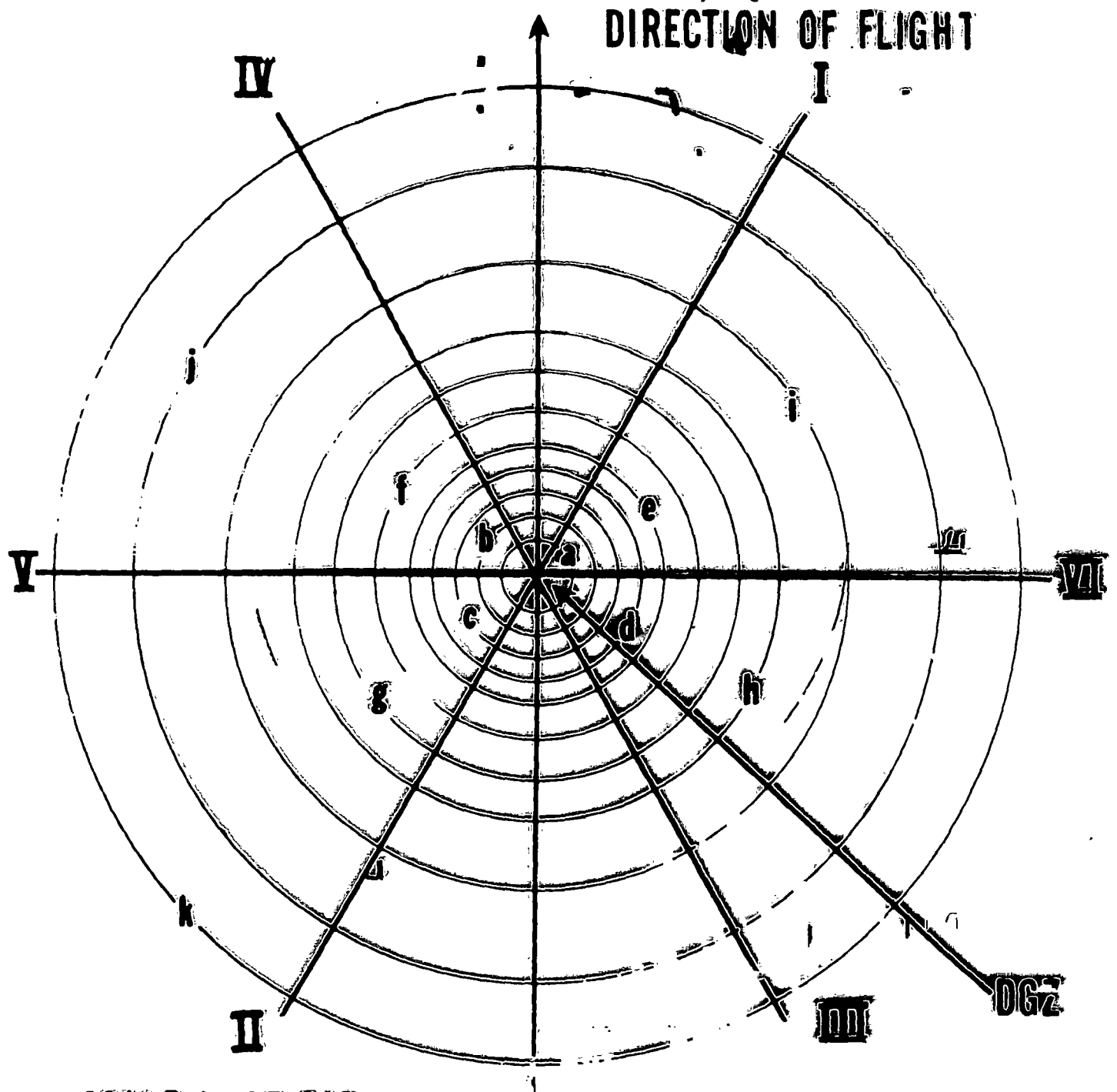
SCALE 1 : 50,000

HORIZONTAL DISPERSION TEMPLATE **SURFACE TO SURFACE MISSILE** **SAM (SURFACE TO SURFACE ROLL)** **AIR FORCE DELIVERED WEAPONS** **DIRECTION OF FLIGHT**



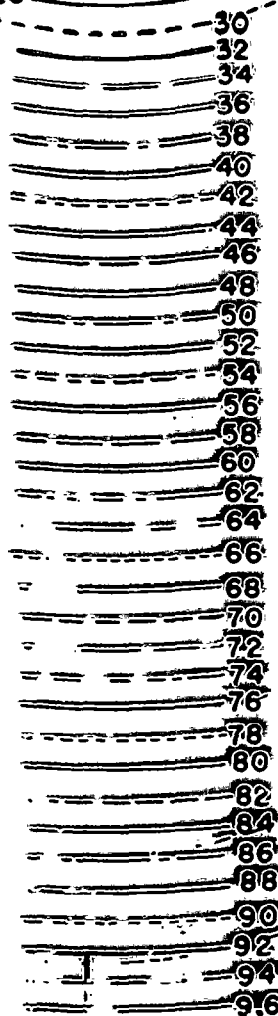
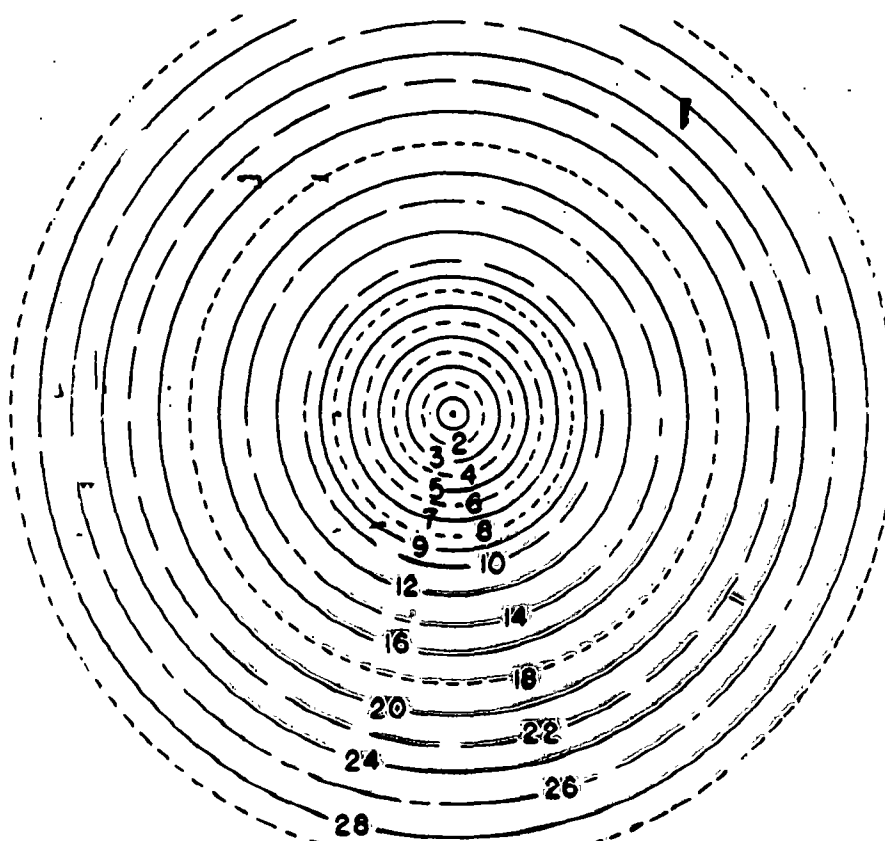
SCALE 1 : 50,000

HORIZONTAL DISPERSION TEMPLATE SURFACE TO SURFACE MISSILE SAM (SURFACE TO SURFACE ROLL) AIR FORCE DELIVERED WEAPONS



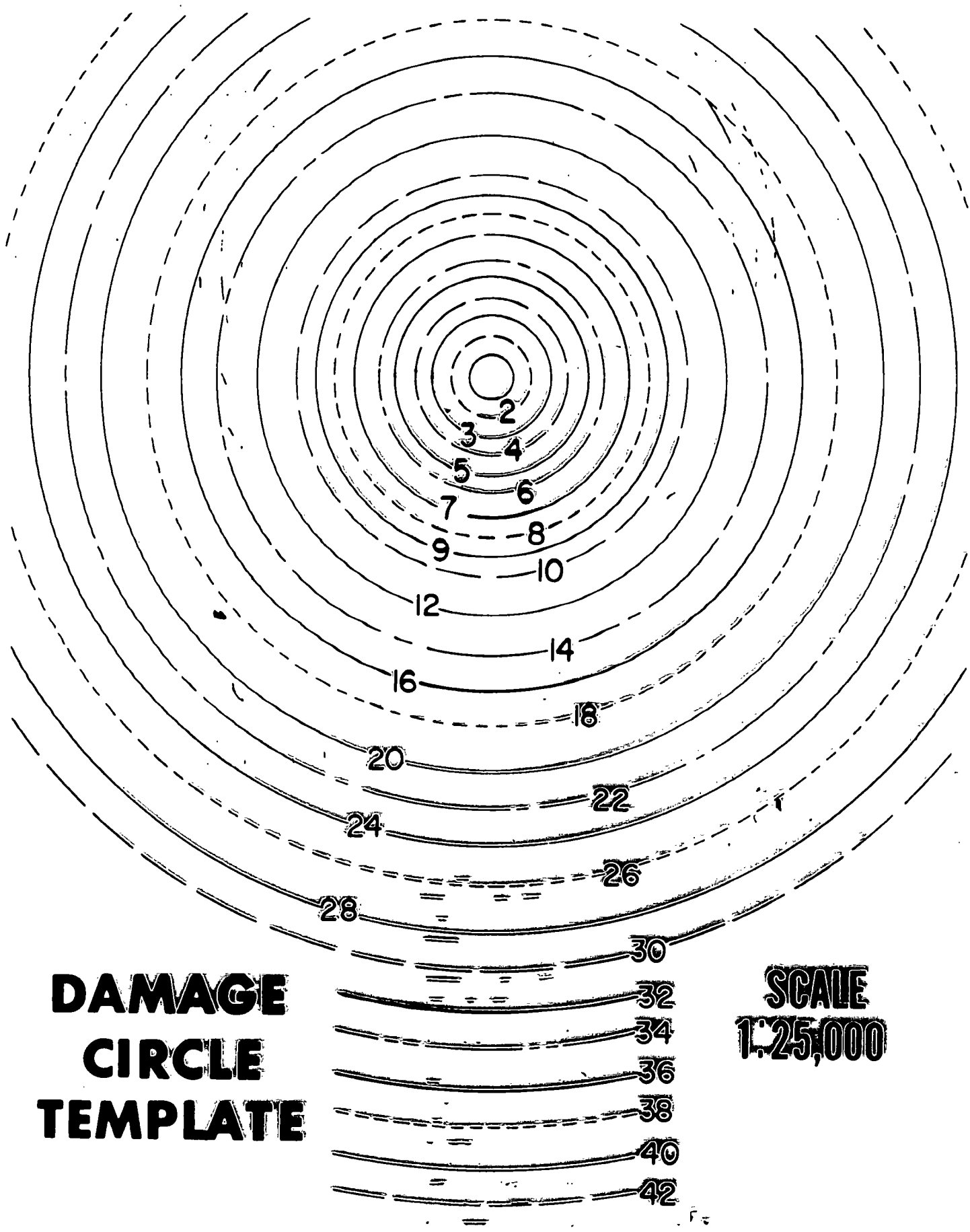
SCALE 1:25,000

DAMAGE CIRCLE TEMPLATE



SCALE
1:50,000

9,600 METERS



**DAMAGE
CIRCLE
TEMPLATE**

**SCALE
1:25,000**

